

pp. 1-191 [key to Hispaniolan polydesmoid families, page 78, separates the Eoromidae, Hercodesmidae, Stiodesmidae, and Chytodesmidae].

———. 1941. Millipeds collected in Puerto Rico and the Dominican Republic by Dr. P. J. Darlington in 1938. Bull. Mus. Comp. Zool., vol. 88, no. 2, pp. 17-80 [key, page 67, to the West Indian genera of Chytodesmidae, includes nine genera. Loomis is the only recent worker to consistently recognize Cook's family names].

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**NOTES ON AMERICAN MOSQUITO PUPAE. III. DESCRIPTION OF NEARCTIC SUBGENUS MANSONIA AND KEY TO ALL NEARCTIC SPECIES OF THE GENUS MANSONIA<sup>1</sup>**

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Mosquitoes of the genus *Mansonia* Blanchard are among the most fierce biters of all the mosquito pests (Pratt, 1953). Medically, *Mansonia perturbans* (Walker) has been incriminated as a vector of eastern encephalitis by Howitt *et al.* (1949), while Gilyard (1945) stated that *Mansonia titillans* (Walker) could be a possible vector of Venezuelan equine encephalitis. Therefore it is important to be able to recognize all stages of these important species, including the pupae, here described.

The objectives of this study are two-fold: (1) to completely describe the chaetotaxy and other taxonomic characters, *e.g.*, trumpet and paddle, of the pupae of the subgenus *Mansonia* Blanchard of the Nearctic region and (2) to formulate an identification key to all the Nearctic species of the genus *Mansonia*.

REVIEW OF LITERATURE

A partial description of the pupae of *Mansonia indubitans* (Dyar and Shannon) was published by Pratt (1945). In 1953 Pratt described three groups of *Mansonia* mosquitoes: the *indubitans* group, the *flarcolus* group and the *titillans* group. He included some information about the chaetotaxy of the pupae, but used only trumpet and paddle characters for the separation of major groups. Perez Viguera (1948) presented a lateral drawing of the pupa of *M. titillans*, but no description of the chaetotaxy of the pupa was included. Darsie (1951) has published a complete description of *M. perturbans* and the reader is referred to this for limited information concerning the subgenus *Coquillettidia* Dyar. Lane (1953) characterized the pupae of the genus *Mansonia*, but included no description of the chaetotaxy.

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The revised system of nomenclature, which was set forth by Belkin (1952, 1953) and modified by Barr and Myers (1962), is used in this paper.

#### PUPAL CHARACTERS OF THE GENUS *MANSONIA*

Edwards (1941) stated that the pupae of the genus *Mansonia* (= *Tacniorhynchus* Lynch-Arribaezaga) are easily recognized by the special adaptation of the respiratory trumpet for piercing plants. He and also Lane (1953) specified that the dendritic tuft (seta 1) on abdominal segment 1 is absent, replaced by a simple seta. Characters on the paddle are also diagnostic. This organ is oblong to lanceolate, notched apically or medio-apically, and with small, irregular denticles on the margins (Edwards, 1941; Darsie, 1951).

The genus *Mansonia* is further divided taxonomically into four subgenera, two of which occur in the Nearctic region: *Coquillettidia* Dyar and *Mansonia* Blanchard. The subgenus *Coquillettidia* is characterized by having all abdominal setae weak and simple and in the Nearctic species by having seta 9 on the cephalothorax double, seldom single. The only species of this subgenus found in the Nearctic region is *M. perturbans*. The subgenus *Mansonia* is distinguished by having several setae on abdominal tergites II-VII long and stout and in the Nearctic species by having seta 9 on the cephalothorax single. The species of this subgenus found in the Nearctic region are *M. titillans* and *M. indubitans*.

#### DESCRIPTION OF THE PUPAE

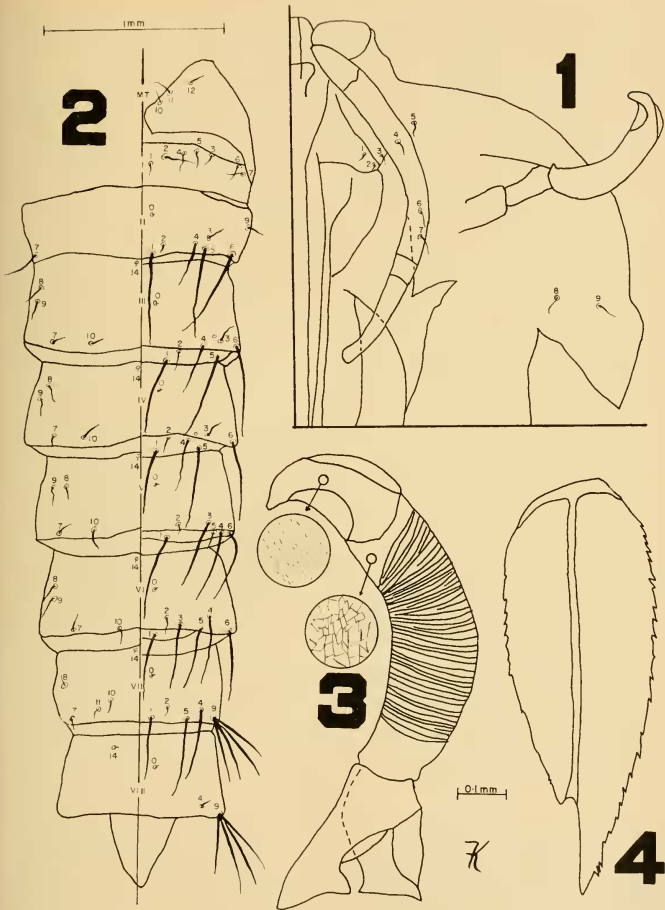
A dark-contrast phase, compound microscope was used to examine the pupal exuviae in this study, which were mounted in Canada balsam using the technique of Darsie (1951).

In order to give the reader an idea of the meaning of terms used in describing seta size, the following approximate measurements were used in the descriptions: minute—less than 5 microns, short—6 to 30 microns, medium—31 to 100 microns, and long—over 100 microns. *Mansonia* (*Mansonia*) *titillans* (Walker)

*Cephalothorax*: (Figure 1) Full complement of nine pairs of setae present, all single. Setae 1, 2 and 3 short to medium; others, medium. *Trumpet*: (Figure 3) thick, length usually five or fewer times its greatest diameter, ranging from 4.75 to 5.2, average 4.8. Terminal portion with a pronounced hook. Trumpet three times or more as long as apical plant-piercing structure, ranging from 3.14 to 3.95, average 3.4.

*Metathorax*: (Figure 2) Three pairs of setae present and single. Setae 10 and 12 medium; seta 11 short to medium, less than one-half (one-sixth to one twelfth) as long as the anteroposterior length of abdominal tergum 1.

*Abdomen*: (Figure 2) All abdominal setae single with the exception of 9 on VII and VIII. Setae 0 minute on on II-VIII. Setae 1 medium on I; long and stout on II-VII. Setae 2 medium to long on I, thin, generally  $\frac{1}{4}$  to  $\frac{1}{2}$  as long as the anteroposterior length of tergum I; medium on II-VII. Seta 3 medium on I, medium to long on II-IV; long, but not so stout on V and VI. Seta 4 medium on I and VIII; long, but not so stout on II-V; long and stout on VI and VII. Setae 5 and 6 medium on I; long and stout on II-VII, excepting 6



(Figures 1-4) *Mansonia titillans*. 1. Portion of the cephalothorax showing setae; 2. Metathorax and abdomen, showing dorsal setae right and ventral setae left; 3. Respiratory trumpet (Camera lucida); 4. Paddle (Camera lucida) (Authors' Coll. No. 1♂).

which is absent on VII. Setae 7 and 8 medium on II-VII. Seta 9 short on I-VI; long and stout, generally 2- to 3-branched (2.5) on VII; long and stout, usually 3- to 4-branched (2.4) on VIII. Seta 10 medium on III-VII. Seta 11 medium on VII. Seta 14 minute on III-VIII. *Paddle*: (Figure 4) lanceolate, pointed apically, shallowly notched medio-apically, margins irregularly denticulate; usually three or fewer times as long as wide, index ranging from 2.7 to 3.2, average 2.9.

This description is based on 2 ♀♀ collected at Boca Raton, Fla. and 1 ♂ from Okeechobee, Fla. (H. C. Chapman).

**Mansonia (Mansonia) indubitans** (Dyar and Shannon)

*Cephalothorax*: (Figure 5) Nine pairs of setae present, all single. Setae 1, 2 and 3 short to medium; others, medium. *Trumpet*: (Figure 7) Long and not so thick, length usually six or more times its greatest width, ranging from 6.3 to 9.6, average 8.3. Terminal portion slightly curved, but without a pronounced hook. Trumpet 2.5 or fewer times as long as apical plant-piercing structure, ranging from 2.02 to 2.42, average 2.25.

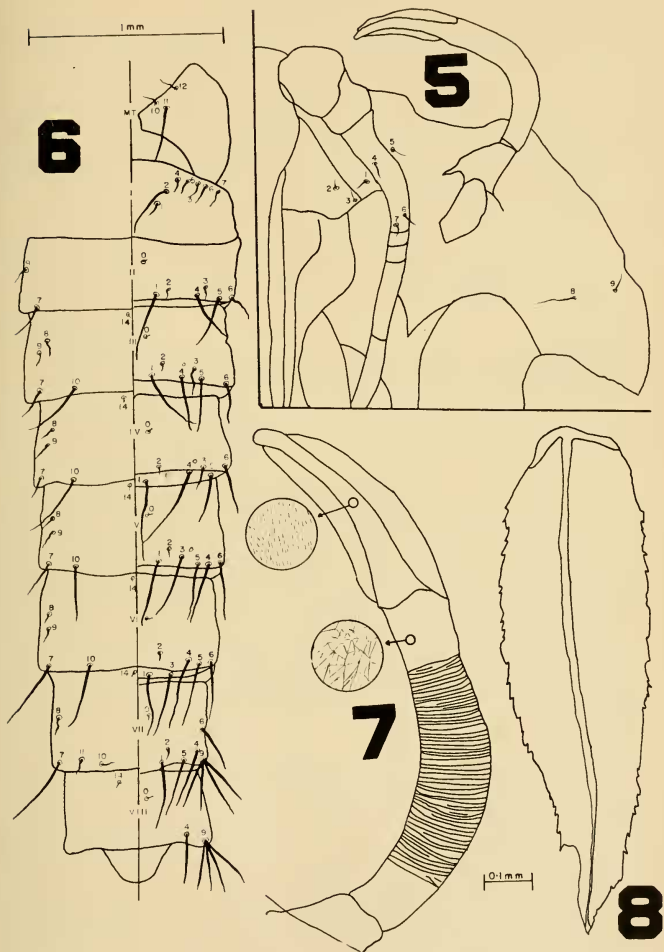
*Metathorax*: (Figure 6) Three pairs of setae present and single. Setae 10 and 12 medium; Seta 11 stout, long, subequal to the anteroposterior length of tergum I.

*Abdomen*: (Figure 6) All abdominal setae single with the exception of 9 on VII and VIII. Seta 0 minute on II-VIII. Seta 1 medium on I; long and stout on II-VII. Seta 2 long and stout on I, length subequal to the anteroposterior length of tergum I; medium on II-VII. Seta 3 short on I; medium on II-IV; long and stout on V-VII. Seta 4 medium on I; long and stout on IV-VIII; long, but not as stout on II and III. Seta 5 medium on I; medium to long on II; long and stout on III-VII. Seta 6 medium to long on I and II; long and stout on III-VI; present on VII, medium to long, single. Seta 7 medium to long on II-V; long and stout on VI and VII. Seta 8 medium on III-VII. Seta 9 short on I-VI; long and stout, generally 3- to 4-branched (2.4) on VII; long and stout, usually 4- to 5-branched on VIII. Seta 10 long and stout on III-V; medium to long on VI; medium on VII. Seta 11 medium on VII. Seta 14 minute on III-VIII. *Paddle*: (Figure 8) lanceolate, pointed apically, shallowly notched medio-apically, margins irregularly denticulate. Paddle usually three or more times as long as wide, index ranging from 2.9 to 3.8, average 3.4.

This description is based on 2 ♀♀ and 2 ♂♂ collected at Boca Raton, Fla. and 1 ♀ from Okeechobee, Fla. (H. C. Chapman).

#### DISCUSSION

The pupa of *M. titillans* is characterized by its relatively short, thick, respiratory trumpet, which is five or fewer times as long as its greatest diameter, and terminates in a pronounced hook. The trumpet of *M. indubitans* is longer, not so thick, and the length is usually six or more times its greatest width. The terminal portion of its trumpet is slightly curved, but lacks a pronounced hook. The chaetotaxy of the two species differs in some respects. Seta 11 on the metathorax and seta 2 on abdominal segment I of *M. titillans* is short to medium, no more than half the anteroposterior length of tergum I. The same setae on *M. indubitans* are markedly longer, subequal to the anteroposterior length of abdominal tergum I. Ventral seta 10 on abdominal segments III and IV on *M. titillans* is short, while the same seta is



(Figures 5-8) *Mansonia indubitans*. 5. Portion of the cephalothorax showing setae; 6. Metathorax and abdomen, showing dorsal setae right and ventral setae left (Authors' Coll. No. 2 ♀); 7. Respiratory trumpet (Camera lucida); 8. Paddle (Camera lucida) (Authors' Coll. No. 3 ♀).

long and stout on *M. indubitans*. Seta on abdominal segment VII is absent on *M. titillans*, whereas it is present and medium to long on *M. indubitans*, occurring dorsolaterally on the segment and medio-anterior to seta 9.

KEY TO THE PUPAE OF THE NEARCTIC SPECIES OF THE GENUS *MANSONIA*

1. All abdominal setae weak and simple, seta 9 on the cephalothorax double, seldom single (Subgenus *Coquillettidia*).....*perturbans* (Walker)  
Abdominal segments II-VII with some long, very stout setae dorsally, seta 9 on the cephalothorax single (Subgenus *Mansonia*)..... 2
2. Trumpet thicker and not so long, length usually less than six times its greatest width, terminal portion with a pronounced hook; seta 6 on VII absent; seta 11 on the metathorax and seta 2 on abdominal segment I short to medium, no more than half the length of abdominal tergum I; ventral abdominal seta 10 on III and IV short ..... *titillans* (Walker)  
Trumpet longer and thinner, length at least seven or more times its greatest width, terminal portion without a pronounced hook; seta 6 on VII present, medium to long; seta 11 on the metathorax and seta 2 on abdominal segment I long, subequal to abdominal tergum I; ventral abdominal seta 10 on III and IV long and stout  
..... *indubitans* (Dyar and Shannon)

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